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EQUITY RESEARCH



15 May 2019

TON Telegram

Cryptocurrencies have come a long way from being the subject of a research paper to becoming a legal payment method and a real investment opportunity as an emerging asset class. Their price performances have sometimes been hard to explain, having peaked in 2017 and crashed in 2018, when the cryptomarket lost over 80% of capitalisation. However, in 2019 the cryptocurrency market is showing signs of revival, and with its capitalisation surging 94% YtD, it is clear that interest in this asset class is returning. Record-high trading volumes (which have doubled in Bitcoin YtD vs its two-year average) is also key to pronouncing renewed interest in the sector.

Growing interest of institutional fund managers (managing both crypto and conventional funds) may be among the key drivers behind the new upsurge in cryptocurrencies and may completely change the market in future. Since the beginning of 2019 institutional investor activity on the cryptocurrency market has gradually been growing after the slump in 2018, with institutional products' share of trading volumes on cryptocurrency exchanges returning to growth and reaching 19% in Apr 2019 vs. 10% at the bottom in Dec 2018 (Diar report). The number of crypto funds created YtD is 145 with assets under management exceeding \$14bn (or 8.5% of the cryptocurrencies market cap).

Yet the risks remain significant, ranging from technological and security to loose disclosure, weak compliance standards, and nascent regulation. According to Satis Group, the lack of regulation resulted in around 80% of ICOs being found to be scams. **We think this opens up opportunities for reputable issuers with the technical and network edge to capitalise on the growing user and investor interest in the sector and use all benefits of a blockchain-based cryptocurrency.** We believe the new cryptocurrencies that will be successful are those that are (1) an integrated part of the existing social networks' messenger ecosystems used as decentralised payment tools within and outside the network and (2) Fully compliant with regulation in the main markets (notably the SEC in the USA, FCA in the UK, ESMA in the EU).

Next wave of cryptocurrency issuers could literally bring cryptocurrency into each household. We are not surprised that messenger Telegram is working towards launching its own cryptocurrency called GRAM (part of the TON project – a highly secure, fast and decentralised payment system with transaction speed comparable to that of Visa and Mastercard). Facebook is working on launching its own cryptocurrency (according to information in the media), while Samsung and KakaoTalk have integrated crypto wallets in their devices/messenger services. The common denominator among the projects is a significant user network that will materially increase acceptance of the cryptocurrency among the wider public. Facebook has over 2.4bn active users while Telegram messenger has around 250mn, compared to just 35mn registered crypto-wallets in Mar 2019.

Valuing cryptocurrencies is more than a challenge...but currencies with a predictable user base and understood usability such as Telegram's GRAM may be more easily valued using classical methods such as equation of exchange (Quantity Theory) due to their identifiable utility value. Using the equation of exchange gives us an indicative value range of \$3.8-8.6 per GRAM. Obviously, this is a highly theoretical exercise given that the TON project has not been completed nor any GRAMs issued at the date of this report.

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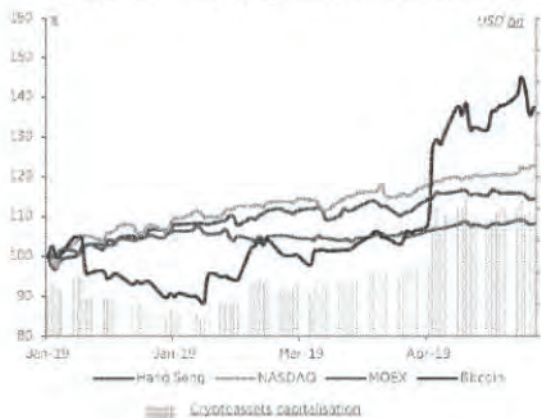
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Investment Summary

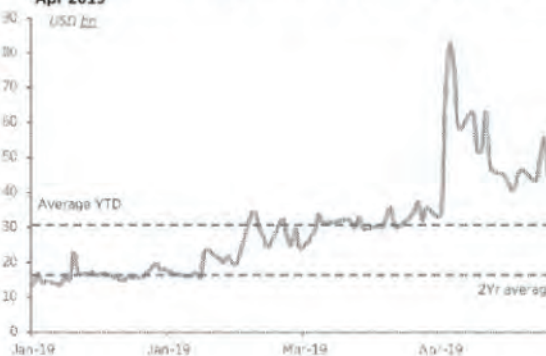
After an explosive 2017 and a disappointing 2018, the cryptocurrency market is reviving, with the trading volume of cryptoassets having reached a historical maximum. Average daily trading volumes for Bitcoin, the largest and best-known cryptocurrency, are exceeding \$17bn, levels unseen since Dec 2017 (and triple the average volumes in 2018), while its performance YtD has surpassed that of major indices.

Figure 1: YTD Bitcoin price dynamics exceed that of major indices



Source: Coinmarketcap, Bloomberg, ATON Research

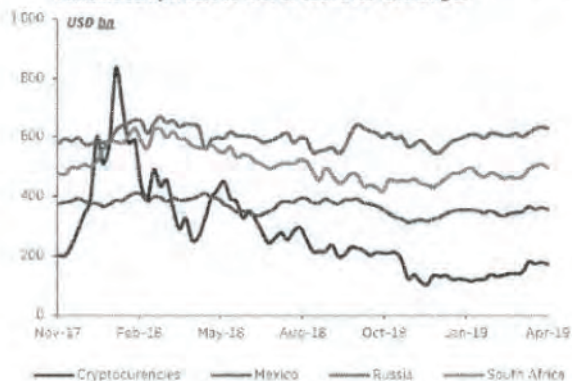
Figure 2: Cryptocurrency trading volume reached historical max in Apr 2019



Source: Coinmarketcap, Bloomberg, ATON Research

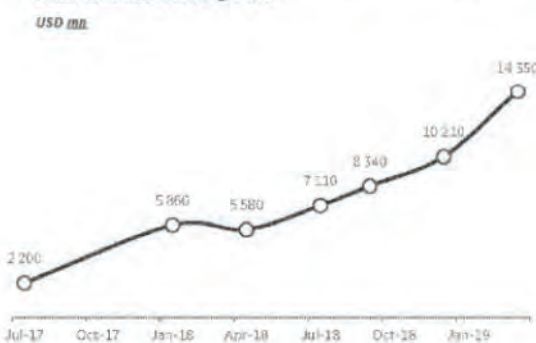
Unlike in the previous cycle, we expect institutional players to drive the next market recovery. Since the beginning of 2019 institutional investor activity on the cryptocurrency market has been gradually growing after the slump in 2018, and their bitcoin trading volumes have returned to growth. The assets under management of crypto funds exceeded \$14bn (or 8.5% of the cryptocurrencies market cap).

Figure 3: In 2018 market cap of cryptocurrencies decreased, yet it remains comparable to that of countries' exchanges



Source: CoinMarketCap, Bloomberg, ATON Research

Figure 4: At the same time assets under management of crypto funds continues stable growth

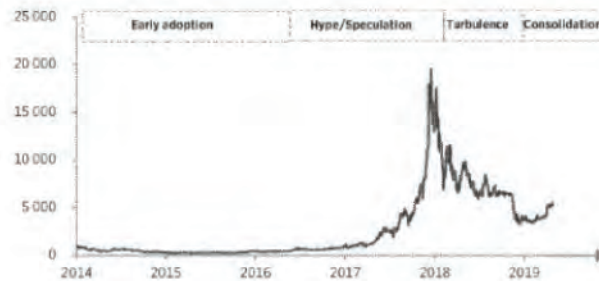


Source: CoinMarketCap, Bloomberg, ATON Research

Rising investor interest in cryptocurrencies is attracting growing regulatory attention. While crypto asset legislation remains rudimentary, important steps have been taken over the past several years, and the subject was raised at the latest G-20 summit. While the SEC continues to delay its decision regarding a possible Bitcoin ETF launch, regulators' closer scrutiny as well as a potentially positive resolution on ETF may unlock significant value to the market.

Blockchain technology to bring notable but indeterminate benefits to the economy.

In the past the cryptomarket was driven by crypto-enthusiasts and speculators trading on hype rather than fundamentals. However, for the banking sector alone, distributed ledger technology (DLT) may unlock between \$15bn and \$20bn of savings by 2022. And that is only the tip of the iceberg, as the application is able to go far beyond finance markets. The technology could be useful in a broad range of industries and activities from voting, gun tracking, validation, and compliance procedure facilitation to sport management, music, entertainment, IoT and messaging apps.

Figure 5: Cryptocurrency market development stages (Bitcoin price as example, \$)

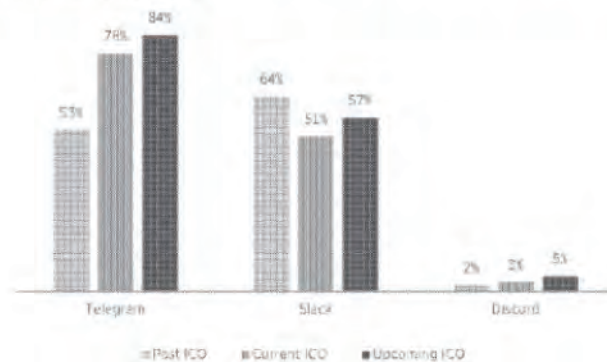
Source: CoinMarketCap, ATON Research

However, cryptocurrencies have embedded problems that still need to be addressed. Among others are high energy consumption, relatively low speed at present, risks of 51% attacks and other security risks, and hard forks. The market and the cryptocurrency is yet to address these issues.

Telegram announced the creation of its ambitious TON blockchain project that may overcome existing challenges if successfully realised. Due to its cutting edge underlying technology based on an infinite sharding paradigm, instant hypercube routing, and proof-of-stake approach, TON blockchain will be highly secure and will allow transaction speeds comparable to that of Visa and MasterCard irrespective of how many participants join the network or the number of transactions.

The technology is the heart of the project, but it is the synergy with Telegram that will bring it to life and facilitate scalability. At present Telegram has a vast and fast-growing user base (expected to reach around 675mn active by the end of 2021), and is ranked among the most popular messengers globally. Indeed Forbes and others have called Telegram the "cryptocurrency world's preferred messaging app", while according to TON's white paper as of late 2017 84% of upcoming blockchain-based projects had an active Telegram community. Telegram users' particular interest in crypto projects may manifest in TON's rapid scalability.

Figure 6: Percentage of blockchain-based projects that have active community in different messengers, Dec-17



Source: White Paper

The components developed in the TON ecosystem will include TON Storage, TON Proxy, TON Services, TON DNS, and TON Payments, which will further increase potential use of the blockchain, will enable the distribution of file-storage technology, will help to achieve anonymity and protect online privacy, as well as empower instant value transfers between users, bots, etc.

New cryptocurrency GRAM to be created as part of TON project, benefiting from vast Telegram messenger user base. TON Wallets will be integrated with Telegram mobile and desktop applications, and Telegram will offer streamlined interfaces for sending value to contracts and paying for purchases in TON. Telegram is evaluating an option to allow compatibility with other major existing cryptocurrency wallet custodians, although GRAM is expected to be the primary means of transacting. Integrated with Telegram apps, the TON wallet may become the world's most adopted cryptocurrency wallet according to its creators.

To implement the project, Telegram performed the largest ICO in crypto world history. In two private funding rounds, Telegram's ICO attracted \$850mn each. In Sep 2018, TON was reported to be 70% ready, while its beta-version was expected later in autumn. In mid-April 2019 *Vedomosti* indicated that Telegram had given access to TON's beta version to a limited number of developers internationally. The news agency also reported that testing may take from three-to-four months to half a year.

Valuation. During the second private round, GRAM's average price according to public sources stood at \$1.33. While it is impossible to determine the intrinsic value of a cryptocurrency (due to cryptocurrencies' limited practical use and relatively low acceptance), we have analysed several approaches in our report, in our attempt to arrive at an indicative value of TON. **There are no widely accepted approaches to cryptocurrency valuation, however the approach that has become the most popular and recognised by the cryptocurrency investment community explained by Chris Burniske and Vitalik Buterin (founder of Ethereum) is the Quantity Theory of Money (Quantity Theory).**

This approach stems from the assumption that cryptocurrency is first and foremost a currency. While the statement is debatable, the potentially wide proliferation of GRAM among the Telegram community (over 280 million users) and the practical application of TON (as a payment for services and goods inside TON's network initially and potentially outside) lead us to believe that the exchange equation approach could, amongst others, be used to establish an indicative theoretical value of GRAM.

We have used an adjusted Quantity Theory of Money in an attempt to arrive at indicative values of a unit in TON. We note that this is a highly theoretical exercise at this point but as cryptocurrencies spread and the space becomes increasingly

populated by institutional fund managers, the search for a widely accepted valuation approach will continue.

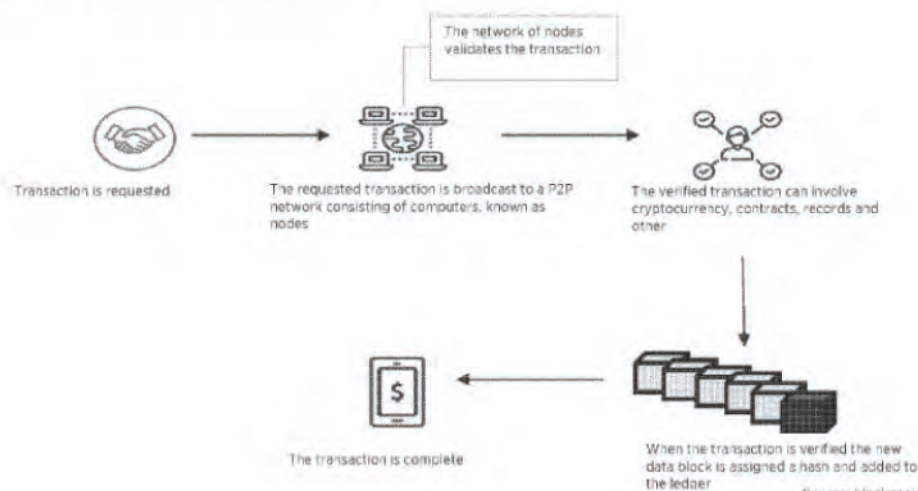
In addition we have used a comparable multiple approach that ultimately compares TON with some cryptocurrencies in circulation.

After using **different approaches to estimate GRAM's potential indicative value, we arrived at a valuation range of \$3.8-6.2 per GRAM.** Price discovery for the cryptocurrency has already started. While official GRAM trading has not started yet, several crypto exchanges (Monex and Xena) have started to quote Telegram futures. For example, Xena Exchange is offering non-deliverable GRAM futures (XGRAM), expiring at the launch of the token or in Feb 2020 at around \$5.9. Since the launch, XGRAM has been trading in a range of \$1.8-2.4 which is close to the implied value of ay Stage (\$2.2) should it take place.

As with any other project there are numerous risks associated with GRAM and TON, which one should carefully review and assess. Among others are the uncertainty of the regulatory framework, the risk of government and private actions, risks related to the technology's development and launch that is an integral part of the success of the whole project, the risk of gram price volatility, etc.

Dipping into the Technology World

Blockchain technology. While the block chain term is widely used these days, numerous polls indicate that the majority of those who have heard the term do not fully understand it. In essence, blockchain is one type of distributed ledger technology that can be described as an approach to storing and exchanging information in a decentralised form without a central authority. Information in a blockchain "database" is not stored in a single location but rather is hosted by millions of computers simultaneously with every participant having access to the data, which enables complete transaction transparency (all users are able to access the information but not copy it). The term blockchain came about as the information about the transactions performed is structured as a chain of related blocks, each of which contains a cryptographic hash (key) to the previous block.

Figure 7: Blockchain transaction process overview

Source: blockgeeks.com, ATON Research

The first blockchain database was devised in 2008 by a person or group of people named Satoshi Nakamoto (as a part of bitcoin's implementation). The initial goal was to create a payment system based on cryptography in which participants would be able to make transactions without a centralised agent. The decentralised structure was intended to avoid transaction commissions, while the absence of a central server would allow faster speed and higher security. Copies of all system users' transactions are permanently being compared to each other. To make the system secure, all transactions are encoded by a secret hash that is known only to the owner of the funds.

Cryptocurrencies are the most well-known application of the distributed ledger technology. Cryptocurrency can be defined as a digital currency that relies on cryptography to generate "coins", perform transactions and prevent fraudulent actions. However, before users are able to access all the benefits of cryptocurrencies (i.e. speed of transactions, absence of commissions and fees etc.) a "coin" needs to be generated. Currently two algorithms exist to mine the coins: "Proof-of-Work" and "Proof-of-Stake".

Proof-of-Work was the first consensus algorithm invented for the blockchain network. The concept was described as early as 1993 in the paper *Pricing via Processing, or, Combatting Junk Mail, Advances in Cryptology*. The idea is that "miners" need to perform "work", i.e. solve a complicated mathematical problem (which is time-consuming and requires significant "computing" effort), in order to generate the hash ("key"). The main cons of this protocol is that the mining process is expensive, time-consuming, and requires significant processing power. Miners compete against each other to be the first to solve the problem and be rewarded. However, due to the limited number of crypto coins, to create a new mathematical problem to solve each time there is a new transaction is becoming increasingly difficult.

There is an alternative approach called **Proof of Stake**. The difference is that the system chooses the block creator in a deterministic way (depending on the block's wealth). While the system also have limited "coins", the PoS miners do not receive the block rewards but rather get the transaction fees. The system will permit to reduce the costs that is designed also to be safer as in case if hacker will try to buy 51%+ coins the system will react by immediate appreciation of the value (the number of validators ("miners") will be unlimited while regulated economically - lower commissions with higher number of validators).

After the cryptocurrency was mined (or bought) one can use it for various purposes including low-cost and fast money transfers, purchase of goods or services, as a mean to store the value and invest in innovative early-stage start-ups that raise necessary funds for development through ICOs.

Cryptocurrency Market

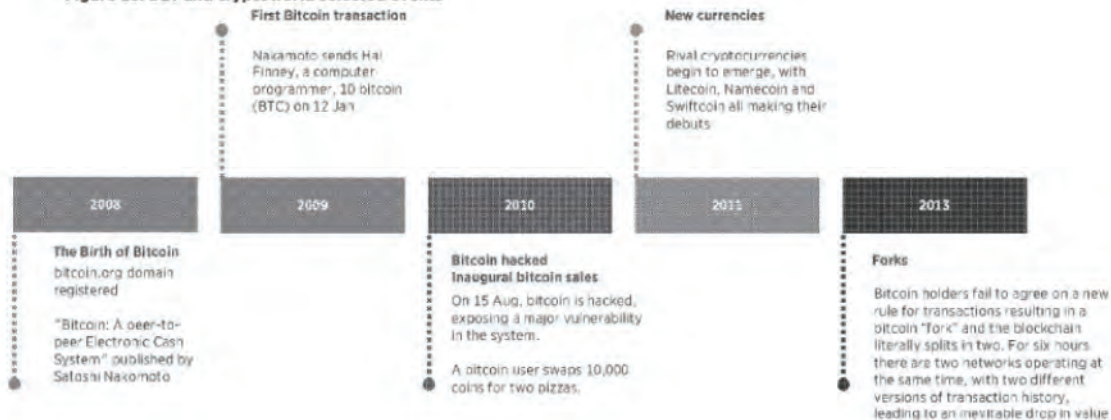
Cryptocurrencies have come a long way from being a research paper to becoming a legal payment method and a real investment opportunity for the general public in certain countries... While the regulation of cryptocurrencies remains at its early stage, in Algeria, Brazil, Columbia, Ecuador, and Slovenia among others, Google searches for "Bitcoin" exceeded those for "Gold".

Figure 8: Number of blockchain wallet users worldwide, ths

Source: statista.com, coincheckup, ATON Research

Figure 9: Cryptocurrencies' market capitalisation exceeded those of developing countries' stock exchange in Dec-17

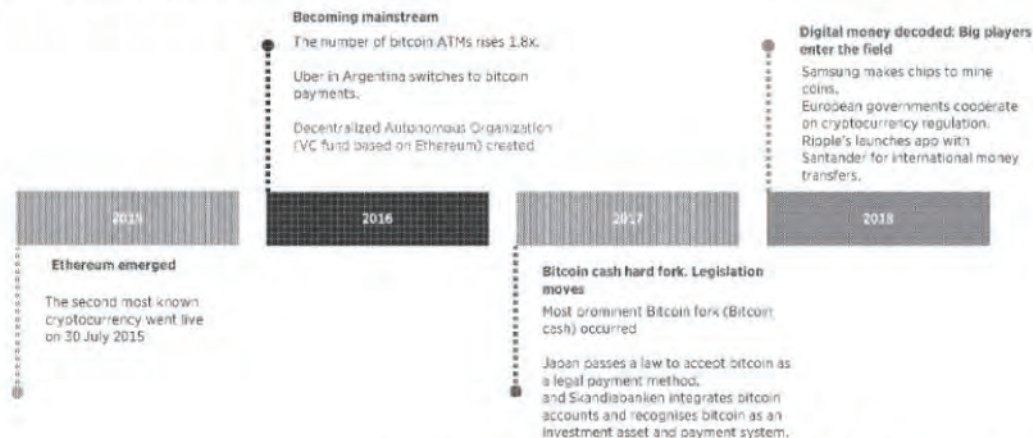
Source: Bloomberg, coinmarketcap.com, ATON Research

Figure 10: DLT and cryptoworld selected events

Source: Telegraph, co.uk, ATON Research

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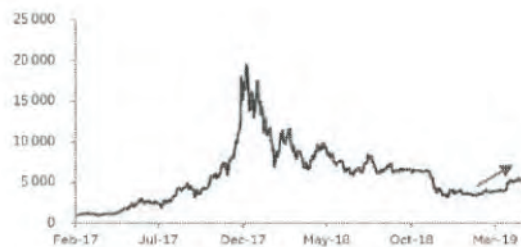
Figure 11: DLT and cryptoworld selected events (continued)



Source: telegraph.co.uk, ATON Research

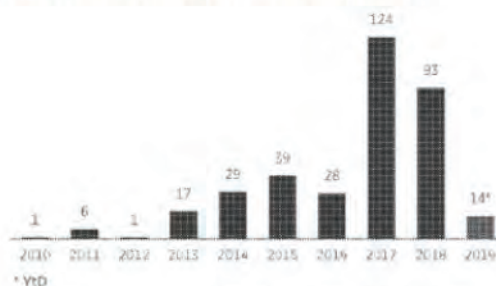
...though the road was bumpy. At every stage of its development, blockchain technology as well as its usage have met severe criticism and the recent cryptocurrency volatility has simply thrown oil on that bonfire. Bitcoin, the preeminent cryptocurrency has been declared dead over 350 times during the decade of its existence, and the higher Bitcoin's capitalisation and the cryptocurrency hype, the greater the criticism.

Figure 12: Bitcoin price, USD: Since 15 Dec 2018 the price is up 63%, (\$)



Source: CoinMarketCap, ATON Research

Figure 13: Number of times Bitcoin declared dead



Source: 99bitcoins.com, ATON Research

Until now, the best year for cryptocurrencies was 2017 with different mass-media publishing articles naming 2017 as the Golden Age of the cryptocurrency. One of the reasons behind the crypto market's 1,200%+ appreciation in 2017 was the surge in initial coin offerings (or ICOs).

The first ICO was performed in 2013 with the practice invented by J.R.Willet. The idea was to use the existing blockchain network (the initial intention was to use Bitcoin, although Ethereum has been commonly used) as a protocol layer on which to build the new rules (or eventually the possibility of easily raising funds through crowdfunding without approaching venture capitalists). In simple terms an Initial Coin Offering is an alternative type of fundraising. The company sells **tokens** and the received money is then used for the business's development. Tokens are sometimes confused with cryptocurrencies although they are not the same (pls see table 9).

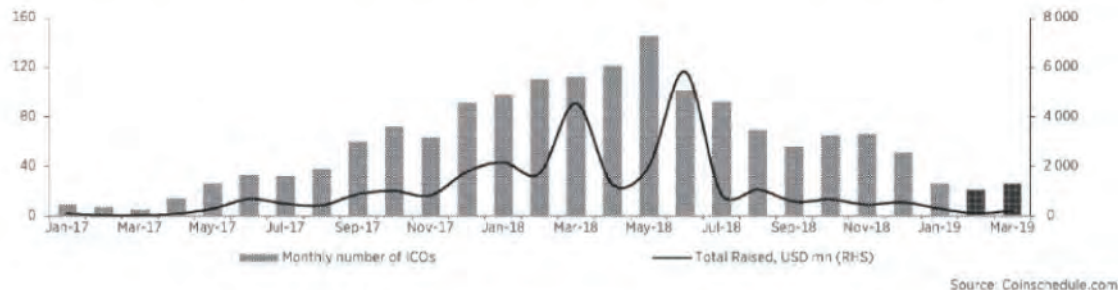
Figure 14: Cryptocurrency vs token comparison

	Coin	Token
Blockchain	Asset native to its own blockchain	Created on existing blockchain
Functions	<ul style="list-style-type: none"> • Main: transfer money, store value, as a unit of account • Rare: to boost transactions in blockchain, to earn dividends, to vote on an important decision over the network 	<ul style="list-style-type: none"> • Security tokens- treated the same way as traditional securities • Equity tokens - token may represent stock or the company that issues it • Utility/application tokens provide access to product or service • Payment token- pay for goods and services
Examples	Bitcoin, Peercoin, Monero, Litecoin, Dogecoin	Ripple, Golem, Metal, Tron, Salt

Source: ATON Research, FINMA

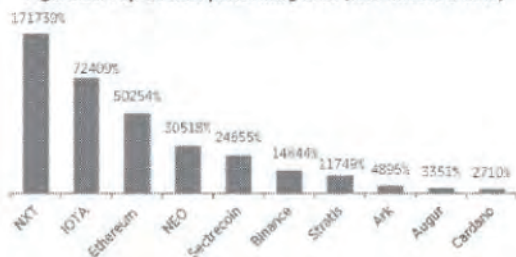
While the idea behind an ICO remains alluring, the lack of regulation resulted in around 80% (according to Satis Group research) of ICOs being found to be scams. Such statistics resulted in the market evolving further by introducing new ways to support blockchain offers. Among the options are: 1) STO (security token offering) similarly to an ICO this method results in an investor receiving tokens, although these are classified as security tokens that represent the ownership information of the investment on the blockchain, which is considered to be a more secure method; 2) IEO (Initial Exchange Offer) which is conducted by an exchange or a platform on behalf of the start-up.

Figure 15: After the peak (by funds raised) in Jun-18, token sales activity cooled down, yet starting to revive in 2019



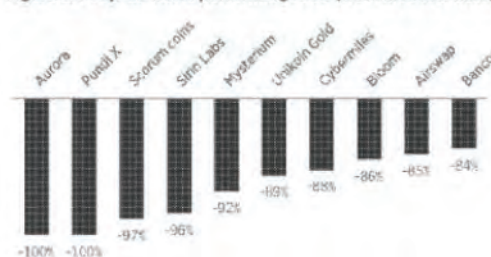
Currently the number of tokens is 1.66x less than the number of cryptocurrencies (1,291 vs 2,140 as of 29 Apr 2019). The market capitalisation of tokens only reached \$15.9bn while the total market cap of cryptocurrencies is \$168.6bn. The tokenisation process is still in its earliest phase that is manifested as extreme volatility in the majority of tokens.

Figure 16: Top-10 best performing ICOs (ROI since ICO date)



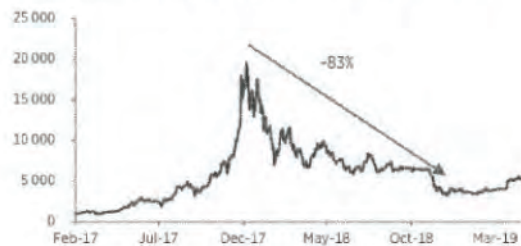
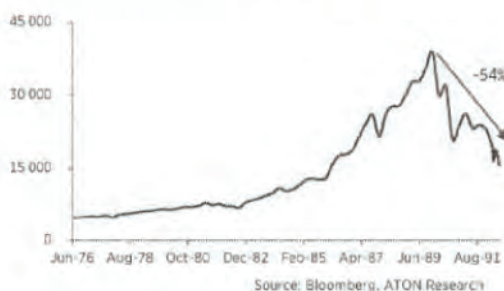
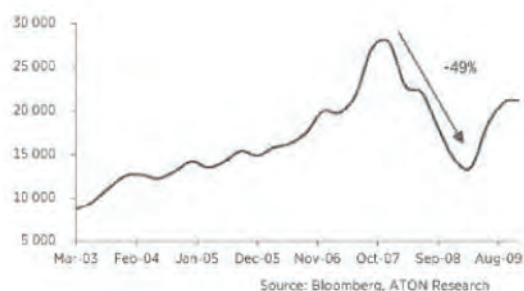
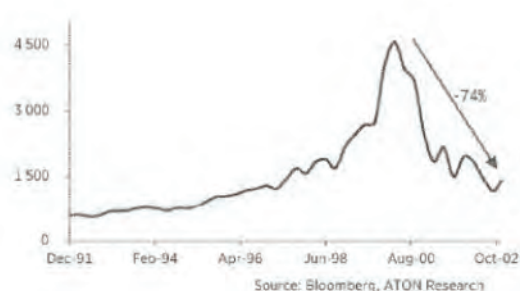
Source: icostats.com, ATON Research

Figure 17: Top-10 worst performing ICOs (ROI since ICO date)

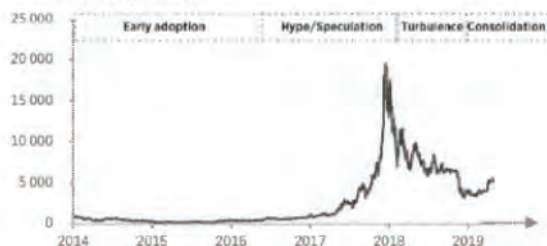
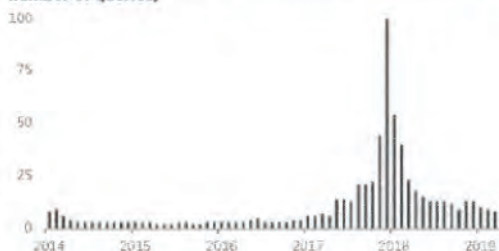


Source: icostats.com, ATON Research

While the ICO activity continued at good pace throughout 2018, the year in general was disappointing for the crypto world with Bitcoin devaluing over 80% from its peak by year-end 2018. However the beginning of 2019 has seen increased attention to the field. With growing regulatory attention, improving legislation and more fresh possibilities for crypto asset applications and implementation, we estimate that another wave of cryptocurrency popularity is simply a matter of time. However, there will likely be significant differences from the previous cycle.

Figure 18: Bitcoin's price crash echoes equity market crises**Figure 19: Nikkel 225 Index (Japan)****Figure 20: Hang Seng Index (Hong Kong)****Figure 21: NASDAQ Index (USA)**

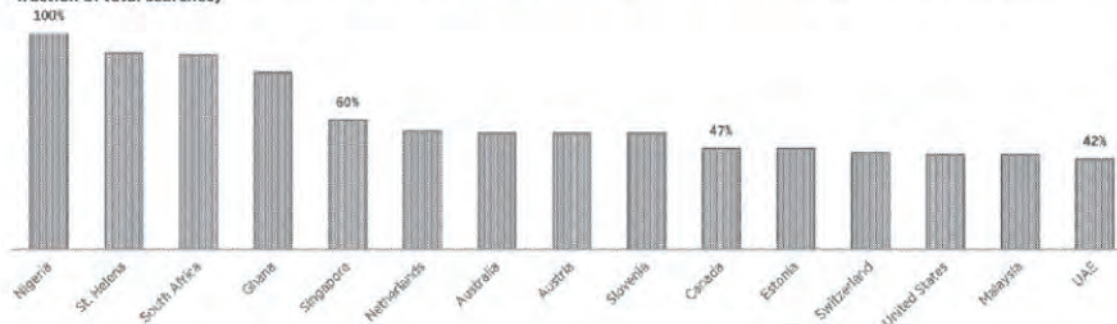
The correlation between the bitcoin price and the number of Google queries of related terms was 91% in 2017 according to *Business Insider*. The strong correlation between the general public's interest and market capitalisation suggests that the fundamental value of the technology was largely neglected; in the absence of clear guidance for participation and fundamental information, the market was driven by rumours and mass media catchy headlines.

Figure 22: The market development stages (based on Bitcoin example), price in \$**Figure 23: "Bitcoin" google queries (where 100 – the highest number of queries)**

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Figure 24: Top-15 countries that search "bitcoin" in Google (scale from 0-100 where 100 is the location with the most popularity as a fraction of total searches)



Source: trends.google.com

New Stage to be Defined By Institutional Investors Taking the Lead

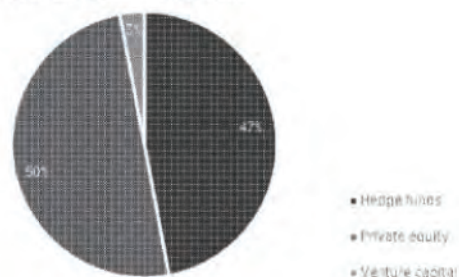
Unlike the previous cycle, we expect institutional players to drive the market recovery, with institutional investors last year showing growing interest in this new asset class. Currently more than 700 cryptocurrency funds exist. Cryptocurrency funds are predominantly created in the form of a hedge or venture capital fund. Moreover, cryptocurrency hedge funds were the fastest growing segment of the hedge fund industry in 2017 according to Cryptofund Research. Notwithstanding tough 2018, assets under management of cryptofunds continued the expansion.

Figure 25: Number of crypto funds created by year



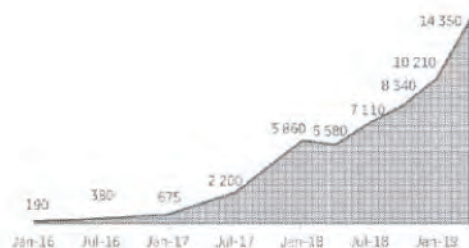
Source: cryptofundresearch.com, ATON Research

Figure 26: Types of crypto funds



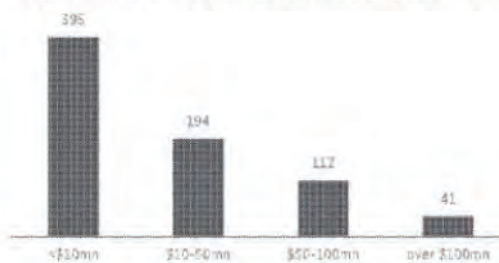
Source: cryptofundresearch.com, ATON Research

Figure 27: Growth of crypto assets under management, mn USD



Source: cryptofundresearch.com, ATON Research

Figure 28: Number of crypto funds by assets under management



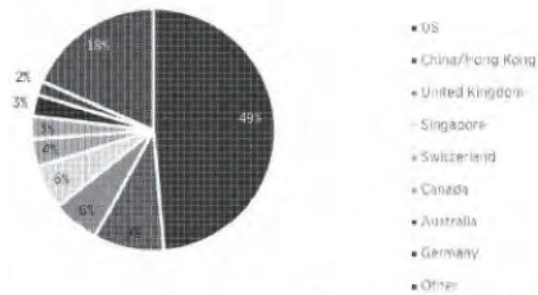
Source: cryptofundresearch.com, ATON Research

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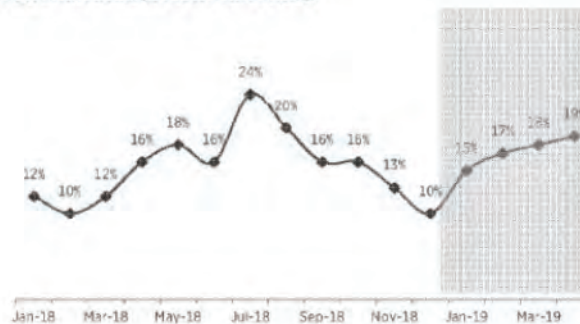
Figure 29: Crypto funds by country



Source: cryptofundresearch.com, ATON Research

As reported by Diar, institutional investors' interest has returned to bitcoin and other cryptocurrencies. Institutional products have been on the rise for four consecutive quarters and have hit new highs as a percentage of total trading volumes.

Figure 30: Institutional products' share rising



Source: Diar, ATON Research

While the interest in the area is evident, the field lacks regulation. Since the creation of DLT technology, its regulation, the regulation of cryptocurrencies and therefore crypto funds has been rather vague (62% of funds based in the US were not registered with the SEC). The development of the field of crypto asset legislation will result in closer attention by regulators that in turn should open them up for big institutional players, which would come as a strong boost to the market (as of 2017 crypto funds accounted for less than 1% of total hedge fund assets).

Clear steps taken to develop the respective infrastructure in 2018-2019

Figure 31: Selected events highlighted

Period	Highlights
1Q18	<ul style="list-style-type: none"> South Korea banned anonymous cryptocurrency trends OSC approves Canada's first blockchain ETF G20 agreed to monitor cryptoassets
2Q18	<ul style="list-style-type: none"> Bittrex launched USD/BTC trading pair SEC does not consider Bitcoin and Ethereum to be securities yet indicates that some others are
3Q18	<ul style="list-style-type: none"> World Bank launches world-first blockchain bond Blockchain Association creation
4Q18	<ul style="list-style-type: none"> Coinbase adds stablecoin tied to USD G20 noted crypto regulation in the declaration
1Q19	<ul style="list-style-type: none"> 20 top industry players (including Binance, Coinbase and Goldman Sachs) meet and discuss future prospects of market development Nasdaq listing on two crypto indices goes live

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Source: CNBC, Bloomberg, ATON Research

The big names rushed to explore the technology. JP Morgan Chase was among the first leading banks to announce plans to launch its own distributed ledger protocol (Quorum) based on Ethereum that aims to enhance collaboration between different blockchain networks. According to CNN the bank has filed a patent with the US Patent & Trademark Office. In a published application the bank described the method whereby users will be able to tokenize their assets (that would become security tokens) and eventually trade these depository receipts.

Another big player that entered the field is **Rabobank**. The bank announced that it would also create its own digital currency, the Rabobit, claiming that it would become a cryptocurrency wallet able to eliminate the gap between online banking and digital cash. However, the project's progress is unknown with latest news dated spring 2018.

Goldman Sachs clears and provides liquidity for Bitcoin-linked futures contracts from the Chicago Board Options Exchange, but its former CFO Martin Chavez said there needed to be a reliable custody solution before the bank could proceed with physical Bitcoin.

In contrast to individual exploration of the technology of distributed ledgers, there are also associations and consortia. For example, six big banks Barclays, Credit Suisse, Canadian Imperial, Bank of Commerce, HSBC, MUFG and State Street developed the first "utility settlement coin". On Accenture estimates, the usage of blockchain technology will allow the global banking sector to save between \$15bn and \$20bn by 2022.

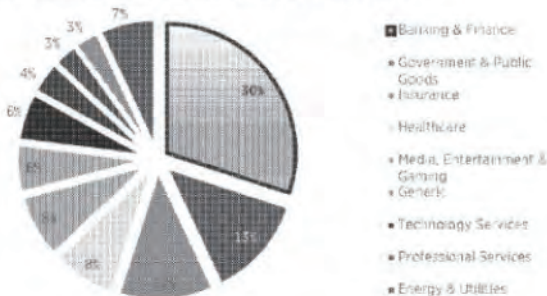
Figure 32: Trade finance DLT consortia

Participants	Description	Milestone
Vetris led by R3 and CryptoBLK		
HSBC, BBVA, NatWest, Bangkok Bank, ING, US Bancorp, Mizuho, BNP Paribas, Scotiabank, SEB, CTBC Bank, Intesa Sanpaolo	Project uses DLT platform to digitalise paper letters of credit to improve the safety and speed of the process. DLT platform was called Corda. In summer 2018 R3 launched a B2B Corda Enterprise.	In 2018 HSBC and ING used the platform to complete a letter of credit for trading giant Cargill. The platform allowed the task to be completed in 1 day vs 5-10 days, on average
Marco Polo led by R3 and TradeIX		
NATIXIS, Standard Chartered, NatWest, Bangkok Bank, BNP Paribas, ING, SMBC, OP Bank, Commerzbank, DNR	Project provides creation of an open infrastructure based on DLT that combines Corda Enterprise and TIX Core to track payments and check receivable discounting for accounting purposes.	In Oct 2017, TIX Core enabled the process to digitally discount receivables and secure credit risk through AIG insurer for a logistics company.
Batavia led by IBM		
BMO, UBS, Erste Group, CaixaBank, Commerzbank	The project uses smart contracts to track and manage open transactions in cross-border trades.	In Apr 2018 successful tests were complete – the platform enabled the import process of German cars and Austrian textiles to Spain with participants being able to monitor the cargo at every stage of transportation.
we.trade led by IBM		
HSBC, Societe Generale, Santander, UniCredit, Natixis, KBC, Deutsche Bank, Nordea, Rabobank	The project offered smart contracts to replace letters of credit in order to speed-up the factoring process for suppliers. Focus on SME in Europe	we.trade was launched in 11 countries. It had executed seven transactions between 10 companies as of July 2018.
Hong Kong Trade Finance Platform led by Hong Kong Monetary Authority		
HSBC, Standard Chartered, DBS, ANZ, Hang Seng Bank, Bank of China, BEA	Aims to digitalise supply chain and recordkeeping and eventually to connect other trade platforms to facilitate cross-border transactions	Expected to go live at the end of 2018

Source: CB Insights, ATON Research

While currently the majority of applications of DLT technology centre on the banking and finance industry, it has potential for significantly vaster implementation. The technology could be useful in a broad range of industries and activities from messaging apps to fishing, from voting, gun tracking, validation and compliance procedures facilitation to sport management, music, entertainment and IoT. Among the most daring application is DeFi (decentralized finance) that essentially aims to reconstruct the banking system with a decentralised architecture. The major advantage of the technology is that it provides greater transparency in a fast expanding digital ecosystem.

Figure 33: Distributed ledger technology use by sectors, 2017



Source: jbs.cam.ac.uk, ATON Research

Figure 34: Current existing projects based on use of blockchain or distributed ledger technology (DLT) by major corporates

Company/Organisation	Implementation	Project description
Microsoft	Identity documentation	Microsoft is collaborating with ID2020 Alliance to solve the problem of a lack of identity documentation globally. Collaborating with Accenture and Avanade on identity prototype based on blockchain.
BHP Billiton	Contract work managing	With the help of Blockapps and ConsenSys BHP Billiton will use technology to record the movements of wellbore rock and fluid samples and secure real-time data.
MAERSK	Freight	Maersk and Hyperledger plan to create a JV aimed at helping participants in its global supply chain to track freight and replace paper-work with digital records.
UPS, FedEx, BNSF Railway	Freight	UPS, FedEx, BNSF Railway and Schneider Trucking joined 200+ other players that are developing a standard framework to explore blockchain technology and applications in freight transport.
Petrotek, Pemex	Oil & Gas	Pemex, the Mexican petroleum company, and Petrotek, an oil & gas tech company, are working on a blockchain-based platform enabling industry-specific global transactions.
UBS, Barclays, Credit Suisse	Compliance	Banks are developing a project that will be built on a private Ethereum blockchain to automate regulatory requirements (MiFID II/MiFIR). Participants will be able to anonymously cross-reference Legal Entity Identifier data and quality check their data to better comply with the new rules.
Walmart, Tyson, Unilever, Nestle, Kroger, Dole, McCormick	Food Safety/Supply tracking	These companies are cooperating with IBM to develop a blockchain pilot aimed at improving the supply chain tracking process and food safety.
United Nations	Humanitarian Aid/Climate	The UN's Climate Change Coalition is exploring blockchain technology to create a transparent system for climate, emissions and carbon trade data. The World Food Programme already uses blockchain to distribute food vouchers.
Tepco and Electron	Energy	Electron is working on a project to switch balancing, settlement and registration operations of utility companies to a shared blockchain.
Illinois government, Hashed Health	Licensing	The Illinois department of Financial and Professional Regulation with Hashed Health are working on a project to digitize medical credential data and automate the workflow related to licensure.
Brazilian government, ConsenSys	Identity documentation	Brazilian Ministry of Planning, Budget and Management is using uPort – a platform built by ConsenSys. The Ethereum-based ID platform will allow users to manage their profiles and will help government to easily check the legitimacy of IDs.
Evernym, Illinois government	Identity Documentation	Evernym in cooperation with Illinois Government's Blockchain Initiative is working on a blockchain-based birth certificate registration system.

Source: CB Insights, ATON Research

Figure 35: Existing projects based on the use of blockchain or DLT (continued) by major corporates

Company/ Organisation	Implementation	Project description
Santander, Ripole	Payments	Santander created the One Pay FX app that use xCurrent, Ripole's payment processing solution, to settle transactions to provide its customers with a solution for international money transfers in near real-time.
IBM	Interbank settlements	IBM worked on IBM's Blockchain World Wire payment network that uses the Stellar protocol to simplify settlement operations of cross-border payments between banks.
Nasdaq, Citi	Banks payments	Nasdaq and Citi are partnering with Chain to automate payment processing from Citi to Nasdaq.
JP Morgan	Interbank Settlements	The bank has filed a patent for a blockchain-powered network to settle transactions between banks.
Amazon, Kaleido	Marketplace	These companies are collaborating to create a plug-and-play marketplace for blockchain services. Amazon Web Services is helping Kaleido to create a blockchain enterprise platform on the cloud integrating blockchain services with Amazon Web Services.
Google	Cloud business	Google is developing a DLT to make it easier for third parties to send and verify transactions. The focus is on offering a blockchain service for the provider to reinforce Google's position on the cloud market.
Facebook	Money transfer	Facebook formed a team that will explore opportunities in DLT and blockchain technology. While little is known about the agenda the group is headed by heavyweights such as David Marcus who earlier led Facebook Messenger, Instagram's former VP of Engineering James Everingham and Instagram's former VP of Product Kevin Weil. Allegedly Facebook is planning to launch a cryptocurrency to enable WhatsApp users to transfer money.
Tencent, Huawei	"Fisco"	Tencent and Huawei are leading blockchain consortium "Fisco" that unifies more than 100 different Chinese companies. The alliance is creating its own blockchain with a focus on fast transactions, while also providing "observatory" nodes to regulators and government.
BBVA	Syndicated loans	BBVA has completed its first \$150m syndicated loan to Red Electrica from MUFG and BNP Paribas via blockchain.
Ant Financial	Money transfers	Alipay parent company created a blockchain service that allows real-time money transfers between Hong Kong and the Philippines, with service being integrated with the Alipay app.
UnitedHealth, Humana, OPTUM, MultiPlan, Quest Diagnostics	Healthcare provider data	The alliance of healthcare organizations are working on a pilot based on DTL technology to provide and store up-to-date data around healthcare providers via a shared database.
Deloitte	Banking	Deloitte in cooperation with five blockchain companies is working on financial products that can later be offered as solutions for banks.
Cisco	Service for developers	Cisco is creating its own permissioned, enterprise blockchain that will enable a wide range of services to developers.
DocuSign, VISA	Smart contracts	DocuSign elaborated the proof-of-concept app that was installed in the Visa car prototype. The use of smart contracts allows an easy and fully electronic process of car purchase or lease.

Source: CB Insights, ATON Research

Cryptocurrency Legislation Is Emerging but Not Firmly Established

At the same time as companies have made varying degrees of progress in accepting and exploring the blockchain and cryptocurrency technology, different countries and regulatory bodies have also been trying to figure out how to treat blockchain and bring it into the regulatory fold. Through 2017-2018 major changes took place in the crypto world with governments trying to warn investors about the possible risks of the crypto assets, while at the same time acknowledging the vast potential of DLT technology. It is evident that the process of creating rules for the crypto world and ICOs will continue to metamorphosize over the next several years.

Figure 36: Cryptocurrency regulation by country (1/3)**The investment community is observing the US's progress with cryptocurrency regulation with great interest.**

At the end of 2017 the SEC published a warning to investors regarding cryptocurrency and ICO markets, acknowledging that at present "there is substantially less investor protection than in traditional securities markets, with correspondingly greater opportunities for fraud and manipulation".

There have also been long discussions about how to classify cryptocurrencies, with different regulatory bodies claiming jurisdiction. The SEC does not consider Bitcoin and Ether to be securities if applying the "Howey Test" from 1946 when the Supreme Court heard the SEC vs Howey case on whether a leaseback agreement was legally an investment contract. At that time it was ruled that a transaction is an investment contract if 1) it is an investment of money; 2) there is an expectation of profits from the investment; 3) the investment of money is in a common enterprise; 4) any profits come from the efforts of a promoter or third party. On the other hand, the regulator claims that it would regulate tokens and digital assets that pass the Howey Test.

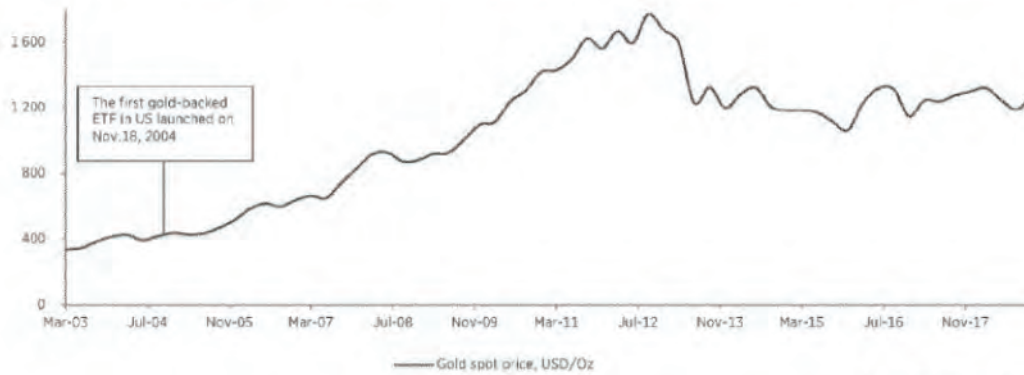
The Commodity Futures Trading Commission (CFTC) has been regulating bitcoin as a commodity since 2015, and in Oct 2017 released *A CFTC Primer on Virtual Currencies* claiming that virtual tokens may be commodities, securities, or derivatives depending on their "actual substance and purpose". With increasing interest from institutional investors in cryptocurrencies, big players in traditional instruments are eager to gain exposure to the cryptocurrency markets. Last year the CME and CBOE launched futures on Bitcoin.

Another important move from regulators is well anticipated soon. While SEC

continues to postpone decision on Bitcoin ETF, if a Bitcoin ETF eventually becomes a

reality, it could be a game changer for the crypto world; we recall the positive effect on gold when its respective ETF was launched in 2003. The ETF would make the cryptocurrency more accessible to a large investor pool and would likely trigger the creation of a new asset class.

Figure 37: The launch of gold ETF since late 2003 boosted the market making gold market accessible for individual, retail investors



Source: Bloomberg, ATON Research

Canada and **Mexico** are also making some headways with respect to the introduction of cryptocurrency regulation, although Canada announced that it would delay its decision until late 2019 after its elections. That said, the country is already fairly open-minded with respect to the use of digital cryptocurrencies including Bitcoin, and in Feb 2018 Canada's regulator approved a blockchain ETF. In Sep 2018 the Mexican government published new crypto legislation and gave vast power to the Central Bank to determine which cryptocurrencies are legal.

In the motherland of cryptocurrencies, **Asia**, the regulation varies dramatically.

Figure 38: Cryptocurrency regulation by country (2/3)



Source: www.loc.gov

While **China** was one of the main markets for cryptocurrency in its early days, the government and the People's Bank of China reconsidered their stance. In 2017 China banned initial coin offerings and later turned to block foreign trading platforms working in China. To comply with the regulations, companies and exchanges involved in cryptocurrencies changed their jurisdictions. For example, Huobi, one of the leading global cryptocurrency exchange platforms moved its operations to Japan.

After the Chinese's government rendered the country unfavourable for cryptocurrencies, **Japan** took the lead, and currently provides amongst the most detailed regulation of the cryptocurrency exchange businesses, permits merchants to

legally accept bitcoin as payment, and works closely with exchanges to improve their safety.

South Korea authorities have come a long way from considering banning cryptocurrency exchanges in 2017 to allowing crypto trading as long as the respective bank accounts are not anonymous.

Figure 39: Cryptocurrency regulation by country (3/3)



Source: www.ioc.gov

The **European Union** has also warned investors of the riskiness and absence of strict regulation of crypto assets (ESMA and EBA jointly issued a warning to investors, Mario Draghi personally cautioned investors), it is moving fast towards the creation of legislation. Since 2015, after the European Court of Justice Ruling, buying or selling bitcoin was exempt from VAT in all EU member states. At the end of 2016, the ECB and the Bank of Japan agreed to collaborate on the "Stella" project in order to explore the possible use of distributed ledger technology for financial markets. On 19 Apr 2018 the European parliament voted on the fifth update to the Anti-Money Laundering Directive that provided closer regulation of virtual currencies. Virtual currency exchange platforms and custodian wallet providers will have to apply customer due diligence controls, including customer verification requirements. Also in March the European Commission presented an Action Plan about the opportunities that fintech represents (AI, DLT, cloud services)

Russia is also in the process of creating a legal framework for cryptocurrencies, and a draft law on digital financial assets was introduced in the State Duma in Mar 2018. According to the bill, mining is a taxable activity if it exceeds the energy consumption limits established by the government for three months in a row. In the document, coins and tokens are classified as property and therefore are not legal tender. The exchange of cryptocurrency for roubles and foreign currencies is allowed although only through licensed operators. Except for cases determined by the Central Bank of Russia, qualified investors are allowed to participate in ICOs.

Crypto-hubs

Some smaller countries are establishing themselves as cryptocurrency hubs and introducing legislation to bring crypto-assets out of grey territory.

In **Switzerland** certain cantons are trying to establish themselves as cryptocurrency friendly territories. In Zug, bitcoin is accepted for payment of administrative costs, while the Commercial Register accepts cryptocurrencies for their fee to form a company. Also in Zug a cluster of blockchain and crypto companies "Crypto Valley" was created.

In Feb 2018 the Swiss Financial Market Supervisory Authority published guidelines for the treatment of ICO, stipulating that it must be decided on a case-by-case basis whether and which financial regulation should be applicable. Also in 2018 the Swiss State Secretariat for International Finance announced that it would form a group that will partner with the Federal Ministry of Justice and FINMA on the legal framework for

financial sector-specific usage of blockchain with particular attention attributed to ICOs.

Gibraltar, Malta and **Bermuda** have also come far in terms of legislating cryptocurrencies and blockchain technologies, indicating that fintech – and specifically blockchain's technology – has significant potential for development and future implementations.

Key Challenges Of The Crypto World

Notwithstanding the undisputable potential of the technology, current cryptocurrencies have their disadvantages and unsolved problems. One of the widely discussed problems is the extremely high **energy consumption** of crypto currencies compared to traditional payment systems, which also means cryptos have a significant carbon footprint.

On the positive side cryptocurrencies' enormous energy consumption is well-known and has been under discussion for a while, with different networks trying to overcome the problem and amend their algorithms. It is clear that the wider application of PoS will significantly improve the situation. This can be illustrated via a comparison of the two most popular cryptocurrencies, Bitcoin and Ethereum. While the Bitcoin network is based on the PoW method that requires substantial computing power, Ethereum that was also earlier operating via PoW has via several hard forks been moving towards PoS.

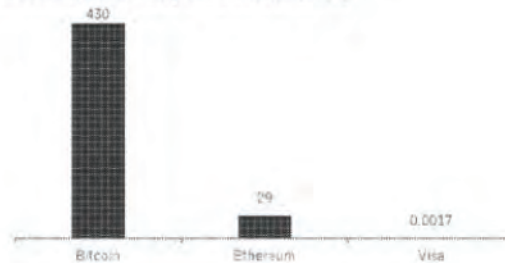
Figure 40: Key statistics of Bitcoin and Ethereum

	Bitcoin	Ethereum
Estimated annual electricity consumption (TWh)	58.85	7.05
Annualised global mining revenues	\$4,171,026,549	\$1,095,197,750
Annualised estimated global mining cost	\$2,942,328,241	\$704,882,603
Current cost percentage	70.54%	64.36%
Country closest in terms of electricity consumption	Colombia	Bolivia
Implied watts per GH/s	0.126	0.005
Total Network Hashrate in GH/s (1,000 GH/s)	53,342	150.4
Electricity consumed per transaction (KWh)	430	29
Number of U.S. households powered for 1 day by the electricity consumed for a single transaction	14.54	0.99
Electricity consumption as a percentage of the world's electricity consumption	0.26%	0.03%
Annual carbon footprint (kt of CO ₂)	27,952	
Carbon footprint per transaction (kg of CO ₂)	204.32	

Source: digiconomist.net, ATON Research

Still cryptocurrency is far from a traditional payment system in terms of optimal energy consumption.

Figure 41: Electricity consumed per transaction (KWh)



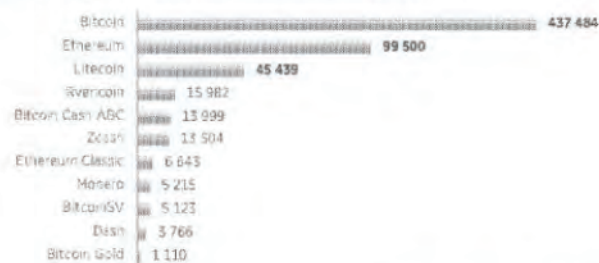
Source: digiconomist.net, ATON Research

51% attacks.

Another problem in the crypto universe is the problem of security and more precisely the increased number of 51% attacks. A 51% attack happens when a group of miners gets control of over 50% or more of the network's mining hashrate. Gaining this control results in the power to reverse transactions, prevent new ones, and the possibility to double-spend coins. In 2018 at least six cryptocurrencies were hit by attacks of this kind – Electroneum, Monacoin, Bitcoin Gold, Verge, Litecoin Cash, and ZenCash.

As the frequency of these attacks increased, numerous possible solutions were discussed and implemented. Some cryptocurrencies introduced amended code and fines for delayed blocks creation, increased the number of confirmations necessary etc. The PoS algorithm may also provide a solution as such attacks are far less likely with PoS than PoW. Acquiring 51% of the network's staked tokens would be significantly more expensive than renting the necessary computing power.

Figure 42: 51% attack 1h cost per different network, USD



Source: crypto51.app, ATON Research

Hard forks may become a threat to the crypto world. A "fork" is an open-source code modification, or amendments to the initial code of the network. There are two types of forks – hard and soft. A soft fork makes amendments in a way that the new blocks will be accepted by an older version. With hard forks the changes in protocol render the older version invalid. According to analysis by Environment Systems and Decisions hard forks were cited as an important problem for the crypto world as investors and users may lose trust in cryptocurrencies' capacity to "survive as a reliable vehicle of exchange".

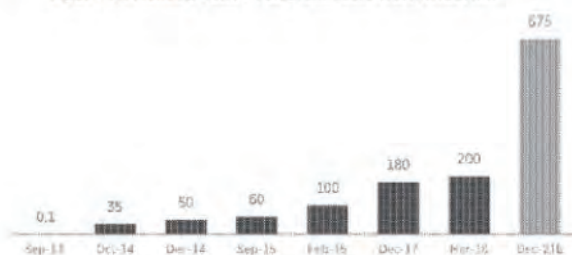
Hard forks can also result in "free money" as the new ecosystem will replicate the coins held by users in the old network. In most cases the new coins will be worthless, but some can represent value. While generating money from air sounds appealing it

undermines the trust in the system and makes cryptocurrencies extremely volatile assets. Among the rare successful forks there are Bitcoin Cash, Bitcoin Gold, Dash, Ethereum (which is a fork of Ethereum Classic). Experts expect the forks to flood the system, and for now there is no clear decision on how to overcome the "fork" problem, but proper governance and transparency as well as larger scale of usage and adoption may be a key to the solution.

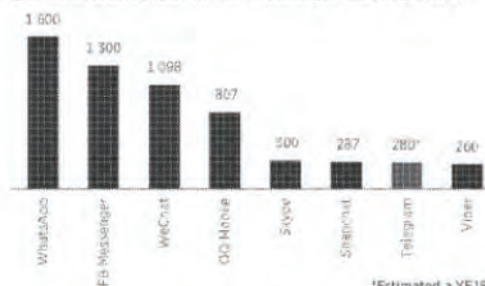
Except for general problems mentioned above there are also broader range related to the technical, legal, economic, and social challenges. Crypto assets still have a long way to go before they are completely trusted and widely adopted, and with respective regulation being very limited, the crypto world still needs to find a balance between its alluring anonymity and the safety of its operations. The DLT business needs to invest in user-friendly designs and provide easy solutions for the broader public as well as to develop a system of incentives to sustain the economics and relations inside the network. All of the above would help to increase the scale and adoption rate of crypto assets and the underlying technology. Therefore, these steps would likely be welcomed not only by tech enthusiasts but also by institutional investors that are stepping into the universe.

Telegram - The Fast Growing Messenger

Pavel and Nikolai Durov created the Telegram messenger in 2013 as a cloud-based instant messaging and voice over IP service with a focus on security and privacy of messages, and offering encrypted chat messaging with client-server encryption for standard chats. Users welcomed the idea, with the speed and the convenience of the app, as well as the absence of advertisements, prompting its user base to skyrocket – from 100k in Sep 2013 to over 280mn by end-2018. Telegram is placed at 6-9th position in different lists of the best or the most popular messenger apps globally. Telegram was created as a not for profit organisation and remains self-funded.

Figure 43: Monthly active Telegram users worldwide, mn

Source: statista.com, ATON Research

Figure 44: Most popular mobile messengers as of Apr 2019

*Estimated a YE18

Source: statista.com, ATON Research

Currently the main growth drivers of the user base are India and South-East Asia, while Russia and Iran accounts for less than a quarter of Telegram customers. The user base is growing at a pace of 40mn new users per year. Telegram's popularity has also been supported by frequent and widely publicised challenging by the messenger's creators of their countries' governments (Russia and Iran). For example in Russia, Telegram refused to provide encryption keys to the authorities which led to messenger being blocked. However Telegram can be used via VPN while the messenger itself has built-in methods to bypass blocks.

Created four years after WhatsApp's launch, Telegram can successfully compete with the market leader. It offers an extremely popular channels feature, and is perceived as much more secure, which is an important advantage in light of increasingly frequent data breaches at other social networks and messaging apps (with Facebook's failures among the most prominent). Consequently at a time times when there are privacy scandals with other major messaging apps, Telegram is experiencing explosive growth. On Mar 14 2019 Pavel Durov wrote in his telegram channel that 3mn new users had joined Telegram within 24 hours.

Telegram has tricks vs other messengers. Among key features that positively distinguish Telegram from other messengers are the ability to have larger groups, higher sending capabilities, and portability of the messenger. It also offer a convenient solution for enterprises that have chatbots and public channels. Importantly the growth is coming

Figure 45: Telegram vs What's App comparison

	WhatsApp	Telegram
Group conversations	Limited to 256 participants	Limited to 100,000 participants
Files and media sending	Up to 16 MB	Up to 1.5 GB
Chatbots	yes	yes
Stickers	yes (with third-party application)	yes
End-to-End encryption	yes	yes, in secret chats
Message editing	no	available within 48 hours
Message delete	available within 51 mins	available within 48 hours
In-app browser	no	yes
Passcode	no	yes
Channels	no	yes
Open API	no	yes
Phone/video calls	yes	only phone calls
Simultaneous access	no	yes
Customization	no	yes
Chats	Can't be transmitted to other device or number	Fully portable as stored in cloud
App's size	135 Mb	140 Mb

Source: geekdashboard.com, ATON Research

Apart from useful features and standing up to authorities that the general public observes with bated breath, it has also received recognition and the press's spotlight with the announcement of its ambitious TON project. Telegram decided to create its own blockchain. With the perfect timing selected and an innovative technological breakthrough at the heart of the project, Telegram managed to complete the largest private ICO in history and attracted \$1.75bn without a public round.

TON's ICO was performed in two rounds in February and March 2018. During the first, \$850mn was raised from 81 investors at \$0.38 per GRAM, its cryptocurrency. In the second round the GRAM price grew to \$1.33 but demand was far from being saturated with 94 new investors participating.

Telegram's creators were not the first to see synergies between messaging apps and opportunities offered by blockchain technologies. Japanese messenger Line launched its cryptocurrency LINK, aiming to increase the adoption of decentralized applications (d'Apps) (though the company did not hold an ICO and distributed tokens through a reward system for using certain services in Line).

Another messenger, the Canadian Kik introduced the Kin cryptocurrency through a \$100mn ICO as a first step to rolling out its crypto economy. Facebook followed suit and announced its plans to create a cryptocurrency for WhatsApp though it has revealed limited details on the future project. According to the recent data "Project Libra" would be used to make peer-to-peer transfers and to make purchases both within the Facebook network and across the internet. Among the most recent also came KakaoTalk, popular South Korean messenger. The integration of a cryptocurrency to the messenger may come as an additional boost for business unlocking innovative products for customers and additional sources of revenue for the companies.

Telegram's TON – A Novel Solution

The Blockchain-based TON network project can be described as a comprehensive ecosystem. According to its whitepaper the platform would be based on the TON blockchain – “a scalable and flexible blockchain architecture” designed in a way to allow the processing of millions transactions per second. Basically TON would become a Proof-of-Stake multi blockchain system that would be constituted from a master blockchain and up to 292 accompanying¹.

The key features of TON blockchain.

Infinite Sharding Paradigm. Necessary for scalability, TON has built-in support for sharding which means that TON blockchains can split and merge automatically to incorporate changes in load. What this means is that TON will be able to generate quick and cost-efficient transactions even in there are millions of them.

Instant hypercube routing. The technology aims to ensure that transactions are processed swiftly notwithstanding the size of the system. The transaction speed will then be comparable to that of Visa and Mastercard that would help to solve one of the major problems of cryptocurrencies.

Proof-of-Stake. As we stated earlier in the report the PoS approach is considered to be the more cost efficient and secure method.

2-D distributed ledgers. The self-healing mechanism in the network allows TON to “grow” the new block of information on top of blocks that has proven to be incorrect.

The platform's flexibility will be achieved via TON's P2P Network that will be used to access the TON blockchains. Blockchain is the core of the ecosystem as well as the underlying technology, however the scalability of the project and its utilisation by a broader share of Telegram's users and the general public will be achieved via the potential use of the TON infrastructure.

Components of the TON Platform

- 1) **TON Storage.** The file-storage technology available for storing arbitrary files with torrent-like access technology and smart contracts used to enforce availability. Apart from the distributed Dropbox it is also necessary for DApps that require large storage amounts.
- 2) **TON Proxy will serve as a network anonymizer** that will be used to hide the identity and IP addresses. It can serve to create the decentralized VPN to secure online privacy. The ultimate goal is, in conjunction with TON DNS and TON P2P Network, to guarantee to any service including Telegram the immunity to censorship.
- 3) **Ton Services** designed as a platform for third-party for DApps, smart contracts and a decentralized browsing experience.
- 4) **TON DNS.** The service will assign human-readable names to accounts that will allow users to access decentralized services as easily as browsing the World Wide Web.
- 5) **TON Payments** will facilitate micropayments through a micropayment channel network. It can be used for instant payments inside the network while the built-in safeguards will ensure the security of value transfers.

Apart from the pure blockchain technology and TON Platform, the creation of the GRAM cryptocurrency is anticipated.

The main competitive advantage of TON is access to Telegram's ecosystem. The TON creators plan to build their own cryptocurrency, GRAM, based on the TON platform. The integration of the TON network and cryptocurrency with Telegram will enable the scaling-up of the project and introduce TON to millions of users. For example, it is anticipated that TON light wallets will be built into Telegram clients with millions of Telegram users being able to store their funds securely in TON's network (while the group is considering the possibility of providing compatibility with existing major cryptocurrencies, the TON coin (GRAM) is expected to be the main means of transaction).

While at present cryptocurrencies are more widely spread among crypto enthusiasts, Telegram's ecosystem will offer simple ways to buy GRAMs and will provide a range of services to spend them on. Telegram's ecosystem includes **Bot Platform as well as Groups and Channels** that together will create a ready market for paid content and subscription services as well as physical goods.

Telegram will also offer a gateway similar to Google App/App Store for blockchain-based projects for the masses. It will provide a list of the most popular apps and tailored recommendations.

Progress made. In Sep 2018 it was revealed that TON was 70% ready with the TON Virtual Machine 95% ready (one of the TON components necessary for smart contracts). The requisite tools at the time were 50% ready while protocols for creating a network that will transmit requests for transactions and new blocks stood at 10% completion. According to *Vedomosti* in Apr 2019 Telegram and gave access to the TON beta version to a limited number of developers internationally. The news agency also reported that testing may take from three-to-four months to half a year.

The Challenges of Valuing Cryptocurrency and the Lack of a Universal Approach

For investments in traditional assets like stocks, fundamental analysis evaluates the financial viability of a company based on its financial statements and other critical information. If the financials are strong, then the company is deemed to have good fundamentals. Performing fundamental analysis for cryptocurrencies, however, is less straightforward for two main reasons.

1. **Firstly, cryptocurrencies are not companies, but rather representations of the value of assets within a network.** Hence, their viability is not based on generating a cash flow. Instead, it depends on the level of engagement from the community that supports it (e.g. users using the service, miners securing the network, and of course the developers).
2. **Secondly, cryptocurrencies are a new and unexplored type of asset,** with their application still fairly limited compared to fiat currencies. Almost all cryptocurrencies are in their infancy with the oldest having been launched in Jan 2009. This means that there is a very small number of use cases and a limited track record that could explain volatility or key drivers.

Therefore, analysis of the indicative value of cryptocurrencies requires different tools and an alternative methodology. Nevertheless, as in traditional share valuation, this methodology should include thorough research of the particular currency's potential areas of use as well as the relevance and applicability of the currency's underlying technology. A good comprehension of a coin's usage is necessary to form one's own opinion and understand its fundamentals, but this is rare in the crypto world due to its complexity.

Applying tweaked off-the-shelf solution and comps to value GRAM

This section of the report details the approach we apply to GRAM's implied valuation, starting with a theoretical background, followed by a brief description of the potential areas of GRAM's use (as per the Whitepaper), an explanation of the rationale behind GRAM's implied valuation, its multiples valuation, and early indications of the value that the brand new GRAM derivative offers.

Value cryptocurrency > combining the equation of exchange and DCF approaches

Cryptocurrency valuation approaches are appearing in an increasing number of publications on cryptocurrencies. The approach that has become the most popular and recognised by the cryptocurrency investment community as explained by Chris Burniske and Vitalik Buterin (founder of Ethereum) is the Quantity Theory of Money (Quantity Theory) ([reference](#)).

As Burniske states in his early [article](#) on cryptoasset valuation, the application of DCF to crypto currency valuation does not seem logical as they are not companies and do not generate cash. Instead, cryptoassets' possible value comes down to projecting each year's current utility value (CUV), which is derived using the equation of exchange. In his more recent publication Burniske writes that the best iteration of cryptocommodity valuation models thus far is that suggested by Rustam Botashev of HashCIB delivered in his "[The Next Step in Cryptoasset Valuation](#)". Accordingly two important adjustments are necessary.

Given that a cryptocurrency's utility may change over time as its adoption and network grow. Firstly, the Incremental Utility Value (IUV, the difference between the current utility value and the previous year's utility value) rather than CUV should be discounted in order to avoid double counting. Secondly, the terminal value of all IUV should be added. Our valuation, therefore, has several commonalities with that proposed by HashCIB. However, it is based on our internal assumptions and understanding of the TON ecosystem's development.

The "Equation of Exchange" is a macroeconomic model used to relate money supply, velocity of money, the price level, and an index of expenditures. The model has two primary applications as a building block of the Quantity Theory of Money (which relates an increase in the money supply to an increase in price levels) and to indicate the demand for money by solving for 'M', the money supply.

$MV = PQ$, where

M – money supply (representing the supply of coins for a given cryptocurrency)
 V – velocity of money in circulation (the average frequency with which a unit of money is spent (or coin, in this case)
 P – price of the digital resource being provisioned
 Q – quantity of the digital resource being provisioned.

A cryptoasset's implied valuation is largely comprised of solving for M, where $M = PQ / V$. M is the size of the monetary base necessary to support a cryptoeconomy of size PQ, at velocity V.

This approach attempts to measure the value provided to users of a cryptocurrency network, and then relates that value to coin supply and velocity in order to derive the value of an individual coin.

As explained by Chris Burniske, "P does not represent the price of the cryptoasset, but instead the price of the resource being provisioned by the cryptonetwork". For example, in the case of TON Payments, this would be the average size of the transaction. Q represents the quantity of the digital resource being provisioned. In the case of TON Payments, this would represent the number of transactions. The dollar amount of the product of P and Q represents the GDP of the TON Payments economy, which fits with classical monetary formula where PQ is the gross domestic product (GDP) of a country.

At a high level, the implied valuation of a cryptocurrency with Quantity Theory of Money comprises the following steps:

- Estimating the addressable market that the given cryptocurrency will reach
- Projecting the supply schedule for a coin (when and how many coins will be available and traded)
- Estimating the velocity of the cryptocurrency
- Assessment of a discount rate to bring future utility to the present

TON valuation includes different elements of the ecosystem

According to the Whitepaper, the TON ecosystem will include the following products:

- **TON Storage** – distributed file-storage technology that can be accessed by the TON P2P network. This technology is available for managing and storing arbitrary files
- **TON Proxy** – a credible network anonymizer/proxy layer aimed at hiding the identities of IP addresses of TON nodes. This layer can be used to develop decentralised VPNs and other blockchain-based alternatives for protecting online privacy and achieving anonymity
- **TON Services** – via this module the ecosystem will provide a platform that can host various third-party services. This ecosystem provides a range of friendly interfaces for decentralised apps and smart contracts, as well as a World Wide Web-like decentralised browsing experience
- **TON DNS** – a service that enables assignment of human-readable names to smart contracts, accounts, network nodes, and services
- **TON Payments** – a robust micropayment channel network that can be used for transferring off-chain value between bots, service/product providers, and users instantly. Also, the TON Payment module has a number of safeguards to make sure that these transfers are as secure as any on-chain transaction.

We estimate the latter to be the largest segment in the TON ecosystem with a total size of approximately USD1.030bn by the end of 2028.

Figure 46: TON Payments valuation volume assumptions

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Telegram MAU, bn	0.30	0.45	0.68	0.81	0.97	1.17	1.40	1.53	1.68	1.83
Share of TON payment users (S-curve)	1%	2%	5%	10%	17%	25%	32%	36%	38%	39%
Average annual transaction volume per user, in \$'000	1.02	1.08	1.13	1.20	1.26	1.31	1.37	1.42	1.46	1.50
Total size of the segment, USD in bn	3	9	31	85	189	353	559	747	893	1,029

Source: Stage A Primer, ATON Research

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We consider all the other segments combined to be much less significant and their total share in the TON ecosystem to be around 2%.

Figure 47: Total volume of other segments

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total size of other segments, USD in bn	0.03	0.10	0.27	0.73	1.84	4.08	7.60	11.96	16.70	21.82

Source: Stage a Primer, ATON Research

Therefore, the total monetary size of the ecosystem in each year can be estimated as follows:

Figure 48: Monetary size of the TON ecosystem

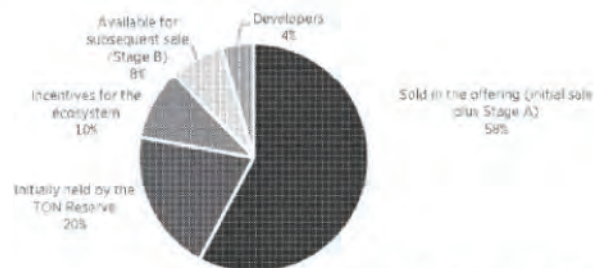
Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Current utility value, USD in bn	3	9	31	86	191	357	566	759	910	1 050

Source: Stage a Primer, ATON Research

According to the Whitepaper, the total supply of native TON tokens (GRAMs) will initially be around 5 billion. At the expected inflation rate of 2%, the total supply of GRAMs will double to 10 billion in 35 years. Here inflation is a payment made by all members of the community to the validators for keeping the system functional.

Possible initial distribution of GRAMs will be as follows:

Figure 49:



Source: Stage a Primer, ATON Research

Also according to the Whitepaper, the number of GRAMs subscribed can be calculated using the formula below:

$$N_{stage} = 10^9 \times \ln \left(1 + \frac{T_{stage}}{10^9 \times p_0} \right), (1)$$

where T_{stage} is the total amount of funds raised in that stage,
 N_{stage} is the total number of GRAMs sold in that stage.

At the initial sale of GRAMs held in Feb 2018 Telegram attracted USD850mn. At the subsequent Stage A in Mar 2018 Telegram attracted an additional USD850mn (Form D). According to the Whitepaper, Telegram was planning to hold a Stage B. We assume that this stage may take place in 2020, during which a further USD850mn may be raised.

If we plug USD1.70bn (total funds raised in the initial sale and Round A) into the formula (1), we obtain the total number of GRAMs sold to be around 3.59bn. Taking into account that 100mn tokens are issued annually, 2.99bn GRAMs will remain in circulation, whereas 200mn of the remaining tokens are locked-up by developers and 500mn tokens are transferred to Stake (4% and 10% of the total supply accordingly).

Figure 50: Number of GRAMs in circulation

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Supply of GRAMs, bn	5.00	5.10	5.20	5.31	5.41	5.52	5.63	5.74	5.86	5.98
Inflation	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Issued GRAMs (inflation and Stage B to be held in 2020), bn	0.10	0.49	0.10	0.11	0.11	0.11	0.11	0.11	0.12	0.12

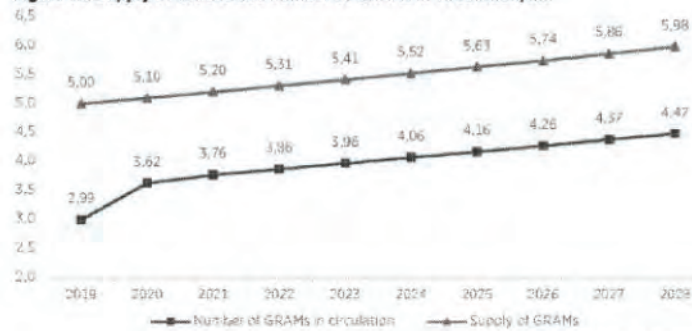
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Number of GRAMs, bn	3.69	4.18	4.28	4.39	4.50	4.61	4.72	4.84	4.95	5.07
Number of GRAMs in stake, mn	500	510	520	531	541	552	563	574	586	598
Number of GRAMs locked-up by developers, mn	200	50	0	0	0	0	0	0	0	0
Number of GRAMs in circulation, bn	2.99	3.62	3.76	3.86	3.96	4.06	4.16	4.26	4.37	4.47

Source: Stage a Primer, ATON Research

Figure 51: Supply of GRAMs and number of GRAMs in circulation, mn



Source: ATON Research

We assume that the Velocity of GRAMs in 2019 will be around 1 as most tokens in circulation will be held by long-term investors. As the ecosystem evolves, its users will have a broader range of options on which to spend tokens, and more of them will use GRAMs as a mean of exchange. We expect GRAMs' velocity to reach seven in 10 years – the average velocity of US M1 over the past 10 years. We assume that the risk profile of the project corresponds to a discount rate of between 25% and 50%, which is a range suitable for high risk start-ups.

Figure 52: Calculation of Implied Indicative Value per GRAM

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	TV
Current utility value (CUV), USD in bn	3	9	31	86	191	357	566	759	910	1,050	
Incremental utility value (IUV), USD in bn	3	6	22	55	105	166	209	193	151	141	263
Share of CUV paid in GRAMs	60%										
Average number of GRAMs in circulation, bn (average)	2.99	3.30	3.69	3.81	3.91	4.01	4.11	4.21	4.31	4.42	4.42
Velocity (S-curve)	1	2	3	5	6	6	7	7	7	7	7
Discounted IUV @ 25% discount rate, USD in bn	2	3	8	17	26	33	33	24	15	11	21
Value per GRAM @ 25% discount rate, USD	0.44	0.41	0.66	0.95	1.18	1.32	1.23	0.86	0.52	0.37	0.70
Share of TV in total value	11%										
Discounted IUV @ 50% discount rate, USD in bn	2	3	6	10	12	13	11	7	4	2	2
Value per GRAM @ 50% discount rate, USD	0.44	0.34	0.46	0.55	0.57	0.53	0.41	0.24	0.12	0.07	0.06
Share of TV in total value	3%										
Implied Value of GRAM, USD											3.80-8.64

Source: Stage a Primer, ATON Research

The application of the exchange formula and incremental UV suggests an implied value of GRAM at between USD 3.8 and USD 8.6 per token, with the bottom of the range being the value after application of the 50% discount rate, and the top of the range being the implied value after the application of the 25% discount rate. The mid-range price, therefore, is USD 6.2.

Listing of GRAM futures indicates that price discovery has started

Although the official trading of GRAMs has not started yet, Xena Exchange (xena.exchange) is quoting non-deliverable GRAM futures (XGRAM), expiring at the launch of the token or in Feb 2020 at roughly \$5.9 per XGRAM.

The value of each XGRAM contract is 1 GRAM. The contract is traded in lots, and each lot is 10 contracts. The minimum order quantity is 1 lot, i.e. 10 GRAMs. Currently, the

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contract is traded without leverage, which will be introduced with the growth of liquidity and turnover.

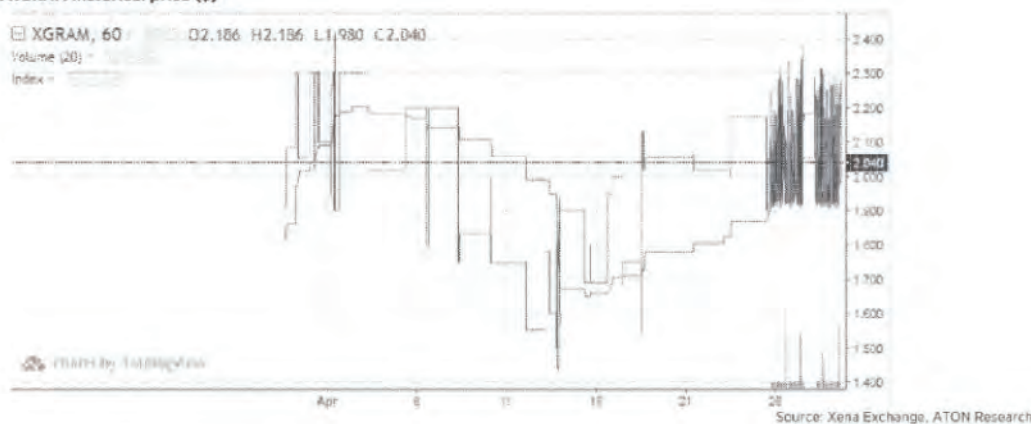
The price of the XGRAM Perpetual reflects market participants' expectations of the future price of the real GRAM token. Once the real token is published and traded on some spot exchanges, the price of the Perpetual will be linked to it.

The .XGRAM_TWAP index is used as the underlying. The index is calculated as the moving average of the price of the last 30 trades of the XGRAM Listed Perpetual.

Since its launch XGRAM has been trading in the range of **USD 1.9 and USD 2.4**, which is very close to the implied price of round B (USD 2.2²) assuming it takes place.

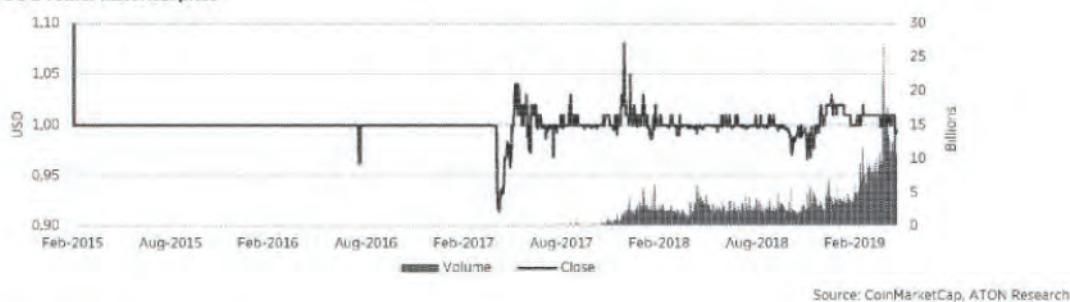
Through this GRAM derivative as a GRAM proxy, investors have started discovering the token market price, which at the current stage of TON's development looks reasonable and can be expected to increase as the platform evolves.

Figure 53: XGRAM historical price (\$)



It is important to note that according to the XGRAM description disclosed on the Xena Exchange website, if the real token is not released, or a reliable index cannot be built for any other reasons by 28 Feb 2020, all XGRAM Listed Perpetual positions will be closed using a price of 5.90 USDT (Tether token) per XGRAM. Tether is a so-called stablecoin and has historically traded at around USD1 per token. This means, that **1 XGRAM can be exchanged for USD 5.9** if the real token is not released by spring 2020. The premium to the current market price of XGRAM reflects the potential transaction risks associated with the transfer of GRAMs to Tether tokens and their consequent sale for USD.

Figure 54: Tether historical price



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Calculated using information presented in the Stage a Primer and assuming USD 850mn were to be attracted at the round B

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Multiples-based indicative valuation

Using statistics provided by CoinMarketCap we have calculated the Median Market Cap to Average Daily Trading Volume (ADTV) multiple of the 50 largest cryptocurrencies by market capitalisation (the product of price per coin and circulating supply). At the time of writing this report, this multiple was 13.1x.

The proxy for GRAM's ADTV was calculated as the number of paying Telegram users by the end of 2028 (Telegram MAU x Share of TON payment users) multiplied by the Share of CUV paid in Grams and average annual transaction amount per user by the end of 2028 and divided by 365. GRAM's ADTV will be USD 1.8 bn. We have also adjusted the ADTV for additional transaction volumes that are not directly related to services or goods sold on the platform (eg. Money exchange, token-to-token exchange and other). According to NewsBTC, for Bitcoins the share of payments Used to purchase goods and services is ca. 0.33%.

Therefore, GRAM's market cap by the end 2028 is expected to be approximately USD70bn. Dividing this figure by the total number of GRAMs in circulation by the end of 2028, we would expect the implied forward looking value of 1 GRAM to be **around USD 16.**

Quantity theory (With Stage B)	XGRAM value as a proxy	XGRAM liquidation value
USD 3.8-8.6	USD 1.9-2.4	USD 5.9

Potential risks

Stage A Primer lists the potential risks associated with the purchase, sale, and use of GRAMs

1. Uncertain Regulatory Framework

The regulatory status of crypto tokens is unclear or not established in many jurisdictions, and it is difficult to predict how authorities in different countries will regulate such technologies. It is also difficult to say how they may change existing laws that will affect crypto currency. Such changes could negatively affect GRAMs in many ways. Telegram and TON Issuer Inc, the wholly owned subsidiary that Telegram formed to act as the issuer in the token sale may cease the distribution of GRAMs, stop the development of the TON Blockchain, or terminate operations in a jurisdiction in the event that governmental or other actions make such distribution, development and/or operations unlawful or commercially undesirable to continue.

2. Legal and Regulatory Factors Relating to Telegram's Business Model Might Present Barriers to Success

The TON Blockchain will operate in a developing legal and regulatory environment. As a result, it is possible that there could be legal disputes over the interpretation of smart contracts used in connection with the TON Blockchain, thus undermining the functionality of the TON Blockchain and GRAMs. The Issuer may need to change its business model to comply with local licensing and/or registration requirements (or any other legal or regulatory requirements) in order to avoid violating applicable laws or regulations or because of the cost of such compliance.

3. Risks of Government and Private Actions

The cryptocurrency market is new and may be subject to increased oversight, including investigations or enforcement actions. There can be no assurance that governmental authorities will not examine the operations of Telegram and the Issuer, or enact regulations or pursue enforcement actions against Telegram or the Issuer, which may result in curtailment of, or inability to operate, the TON Blockchain as intended, or judgments, settlements, fines or penalties against Telegram and the Issuer.

4. Risks Relating to the Further Development and Acceptance of Blockchain technology and Cryptocurrencies

The growth of cryptocurrencies is subject to a substantial degree of uncertainty. The slowing of the development, acceptance, adoption and usage of blockchain networks and cryptocurrencies may delay the adoption of GRAMs.

5. Risks Associated with the Development and Launch of the TON Blockchain

There is significant risk in building and implementing technologies such as TON Blockchain that may never have been used, or that are being used in different ways. There is no guarantee that such technologies will operate as planned and initially declared to operate.

6. Risks Associated with a Lack of Interest in the TON Blockchain

It is possible that the TON Blockchain will not be used by a large number of individuals, companies and other entities and/or that there will be limited public interest in the creation and development of distributed ecosystems (such as the TON Blockchain) more generally or distributed applications to be used on the TON Blockchain. Such a lack of use or interest could negatively affect the development of the TON Blockchain and the potential utility of GRAMs.

7. Risks Associated with the TON Blockchain.

The TON Blockchain may include coding errors or otherwise not function as intended, which may negatively affect the TON Blockchain and the functionality of GRAMs. Any required parameter changes needed to correct coding errors or unintended functionalities of the TON Blockchain may fail to garner the votes by validators and holders of GRAMs necessary to implement such parameter changes. As a result, any

such coding errors or unintended functionalities in the TON Blockchain may remain unresolved.

8. Risk of Losing Access to GRAMs Due to Loss of Private Key(s).

It is expected that GRAMs will be held in a digital wallet or vault that requires a private key or a combination of private keys for access. Loss of the private key(s) associated with the digital wallet or vault storing GRAMs would result in the loss of such GRAMs. Moreover, any third party that obtains access to a private key(s), may be able to misappropriate GRAMs. Neither Telegram nor the Issuer is responsible for any such losses.

9. Risk that the TON Blockchain is Superseded.

There is no guarantee that the technology being proposed to underpin the TON Blockchain will not be supplanted by competing protocols. It is not known whether the TON Blockchain will become the predominant protocol adopted globally by the industry. If the TON Blockchain is surpassed or superseded, GRAM usage and adoption may decline.

10. Risks Associated with Intellectual Property Matters.

Telegram and the Issuer do not currently hold any issued patents and, thus, would not be entitled to exclude or prevent other entities from replicating their technology, methods and processes.

It is possible, however, that third parties have been issued with patents that cover all or a portion of the TON Blockchain. Any claims from patent holders could result in substantial expenses, divert the attention of management or substantially disrupt the operation of the TON Blockchain.

11. Risks of Hacking and Security Weakness.

GRAMs may be subject to expropriation and/or theft. Hackers or other malicious groups or organizations may attempt to interfere with the TON Blockchain or with GRAMs in a variety of ways. Furthermore, because the TON Blockchain will be released as open-source software, hackers or other individuals may uncover and exploit intentional or unintentional bugs or weaknesses in the network which may adversely affect GRAMs or result in the loss of GRAMs or the loss of ability to access or control GRAMs.

12. Risks Associated With Integrating the TON Blockchain and Telegram Messenger.

Although Telegram intends to integrate the TON Blockchain with Telegram Messenger as described in the "Telegram Messenger-TON Integration" section of the Telegram Stage A Primer, Telegram may be unable to achieve the intended technical integration between the TON Blockchain and Telegram Messenger on the terms described in the Telegram Stage A Primer. As a result, adoption of GRAMs as a form of currency within Telegram Messenger's existing ecosystem may be more limited than anticipated.

13. Risks Associated With The Offer and Sale of GRAMs.

Telegram and the Issuer intend to complete the subsequent sale in two stages, as described in the "Token Distribution" section of the Telegram Stage A Primer. There can be no assurance, however, that either stage of the subsequent sale will be conducted as expected.

14. Risk of Price Volatility.

The prices of cryptocurrencies have historically been subject to dramatic fluctuations and are highly volatile, and the market price of GRAMs may also be highly volatile. Several factors may influence the market price of GRAMs, including, but not limited to, a decrease in the price of a single cryptocurrency that may cause volatility in the entire cryptocurrency industry and may affect other cryptocurrencies, including GRAMs.

15. Risks Associated with the Issuer and Use of Funds.

Telegram expects the Issuer to transfer all or a significant portion of the funds generated by the token sale to Telegram. While Telegram and the Issuer intend to use the funds as described in the "Use of Funds" section of the Telegram Stage A Primer,

there is no restriction on Telegram's or the Issuer's use of the funds generated from the token sale or on Telegram's ability to transfer those funds to, or make payments for the benefit of, its affiliates

16. Risks Associated with the TON Foundation.

Over time, Telegram intends to establish the TON Foundation and to transfer responsibilities related to TON and the TON Reserve to the TON Foundation, as described in the "Governance" section of the Telegram Stage A Primer. There is, however, no timetable for the establishment of the TON Foundation or the transfer of the responsibilities related to TON and the TON Reserve to the TON Foundation, and it is possible that the TON Foundation may never be established or that the responsibilities and/or assets transferred to the TON Foundation may differ from current expectations.

Glossary

Blockchain is a system in which a record of transactions made in bitcoin or another cryptocurrency are maintained across several computers that are linked in a peer-to-peer network

Proof of Stake (PoS) is a category of consensus algorithms for public blockchains that depend on a validator's economic stake in the network

Proof of Work (PoW) is a requirement to define an expensive computer calculation, also called mining, that needs to be performed in order to create a new group of trustless transactions (the so-called block) on the blockchain

Fork is what happens when a blockchain diverges into two potential paths forward — either with regard to a network's transaction history or a new rule in deciding what makes a transaction valid

P2P Network (peer-to-peer network) distributed application architecture that partitions tasks or workloads between peers

Decentralization – redistribution of functions and the right to make decisions between the participants of the system without a single governing body

Validator is someone who is responsible for verifying transactions within a blockchain

Hash is a function that converts an input of letters and numbers into an encrypted output of a fixed length

Cryptocurrency is a digital asset designed to work as a medium of exchange that uses strong cryptography to secure financial transactions, control the creation of additional units, and verify the transfer of assets

ICO (Initial Coin Offering). An unregulated means by which funds are raised for a new cryptocurrency venture

STO (Security Token Offering) is a type of fundraising that is performed with a company offering tokenized securities

IEO (Initial Exchange Offer) is a token sale that is held at the exchange

Hashrate is the speed at which a computer is completing an operation in the Bitcoin code

Token is a unit of value issued by a tech or crypto start-up, intended to be a piece in the ecosystem of their technology platform or project